MDI-12 2D Imager Engine

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Document History

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Revision History

Product Name : MDI-12

Edition	Date	Page	Section	Description of Changes
1st	2026/02/06	-	-	Initial release

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1. Overview

This manual provides specifications for the MDI-12 imager engine.

2. About the MDI-12 Imager Engine

The MDI-12 is a low-profile, imager-based, ultra wide-angle imager engine that has an integrated decoder. The imager engine enables high-speed scanning of 1D (linear) and 2D codes, as well as OCR fonts.

The MDI-12 includes these features:

- New optical system
  The ultra wide-angle proximity readable optical system can read general QR codes at close proximity, as well as wide barcodes* and large QR codes* from a distance of about 40 - 45 mm.
  *Specified code

- Low-profile imager engine
  The imager engine's space-saving size makes it ideal for kiosks and payment terminals.

- Ambient light immunity
  A special optical filter with sunlight resistance and industrial CMOS sensor control enables readings up to 120,000 Lux.

- Highly sensitive imager
  Even in the dark, the MDI-12 can read label codes using a small amount of ambient light from the device's screen or indicator lights. The MDI-12 also has a control function for the external illumination circuit to compensate for low light conditions, allowing the illumination to turn on during reading.

- High-speed image sensor
  The high-speed global shutter CMOS image sensor in the MDI-12 captures images at a speed of up to 120 fps. This feature enables fast and accurate scanning.

- Low power consumption
  The high-performance and customized low-power 800MHz CPU has drastically minimized the power consumption in operating, standby, low power states, and booting.

- Data Edit Programming
  The combined output is highly configurable using regular expressions. GS1 data conversion and code coordinate output is also supported.

- RoHS compliance
  The MDI-12 is a RoHS compliant product, as declared by Optoelectronics Co., Ltd.

3. Physical Features

3.1. Dimensions

Imager Engine (MDI-12): 25.3 × 21.0 × 10.5 (WDH: mm)

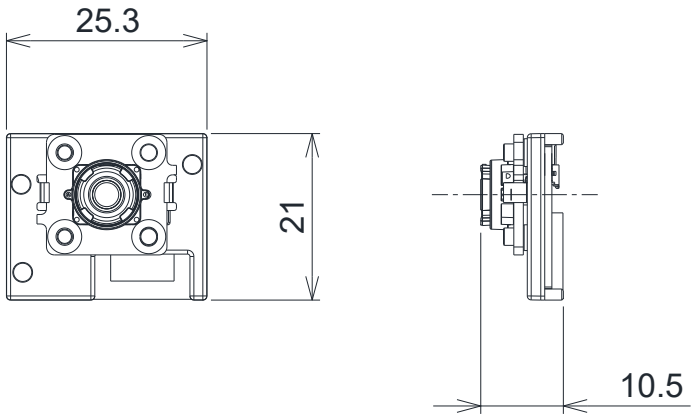


Figure 1: Dimensions of the MDI-12

3.2. Weight

Imager Engine (MDI-12): 3.7 g (max)

4. Electrical Specifications

4.1. Absolute Maximum Ratings

Note: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Voltage	Symbol	Rated Value	Unit
Power Supply Voltage (V_{CC} to GND)	V_{CC}	-0.3 to 6.0	V
Input Voltage	V_I	-0.3 to V_{CC} +0.3	V

4.2. Recommended Operating Conditions

Voltage or Current		Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage		V_{CC}		3.0	3.3/5.0	5.5	V
Input Voltage	Low	V_{IL}	Vcc=3.0 to 3.6V	0	-	0.8	V
			Vcc=4.5 to 5.5V	0	-	0.3*V_{CC}	
	High	V_{IH}	Vcc=3.0 to 3.6V	2.0		Vcc	V
			Vcc=4.5 to 5.5V	0.7*Vcc		Vcc	
Output Voltage	Low	V_{OL}	I_{OL} = 100μA		-	0.1	V
	High	V_{OH}	I_{OH} = 100μA	Vcc-0.1	-	V_{CC}	V
Output Current	Low	I_{OL}				-25	mA
	High	I_{OH}				-25	mA

* Measured at the MDI-12 connector.

4.3. Current Consumption

(IF: UART/USB, V_{CC} = 3.3V/5.0V T_A = 25°C)

Current	State	Symbol	Conditions	Min.	Typ.	Max.	Unit
Peak Rush Current *	Boot	I_{PK}	-	-	1000		mA

* Measured at the MDI-12 connector.
* Peak current width is 800μs. (Typ.)

UART

[V_{CC} = 3.3V] (IF: UART, T_A = 25°C)

Current	State	Recovery Time *1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read	-	I_{OP}	-	-	170	230	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	29		mA
Low Power Current	Low Power	37 ms	I_{LOW}	Configured*2	-	0.8		mA

[V_{CC} = 5.0V] (IF: UART, T_A = 25 °C)

Current	State	Recovery Time *1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read	-	I_{OP}	-	-	100	150	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	19		mA
Low Power Current	Low Power	37 ms	I_{LOW}	Configured*2	-	0.6		mA

*1 Recovery time is time until ready to scan.
*2 Refer to the “Serial Interface Specifications” for details.

USB

[V_{CC} = 3.3V] (IF: USB, T_A = 25°C)

Current	State	Recovery Time *1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read	-	I_{OP}	-	-	210	290	mA
Standby Current	Standby	0 ms	I_{STB}	*2	-	65		mA
Low Power Current	Low Power	37 ms	I_{LOW}	Configured*2*3	-	1.0		mA

[V_{CC} = 5.0V] (IF: USB, T_A = 25°C)

Current	State	Recovery Time *1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read	-	I_{OP}	-	-	127	190	mA
Low Power Current	Standby	0 ms	I_{STB}	*2	-	45		mA
Low Power Current	Low Power	37 ms	I_{LOW}	Configured*2*3	-	0.8		mA

*1 Recovery time is time until ready to scan.
*2 Current value when USB is in “Selective Suspend” mode. When using as USB-COM (USB as virtual COM), use USB driver “Opticon USB Code Reader driver” version 3.x.x.x.
*3 Refer to the “Serial Interface Specifications” for details.

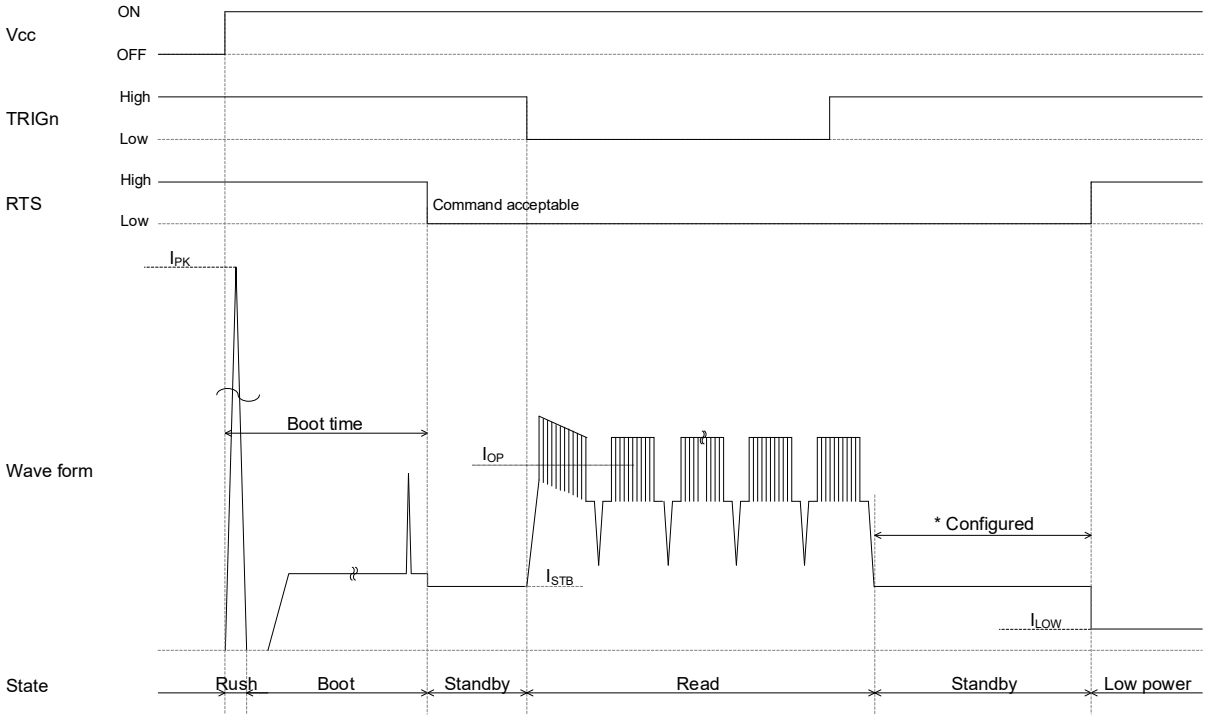
4.4. Recovery Time from Power Down State

(IF=UART/USB, V_{CC} = 3.3V T_A = 25°C)

Boot Time	Conditions	Min.	Typ.	Max.	Unit
Boot time	*	-	360	1000	ms

* Refer to the “Serial Interface Specifications” for details.

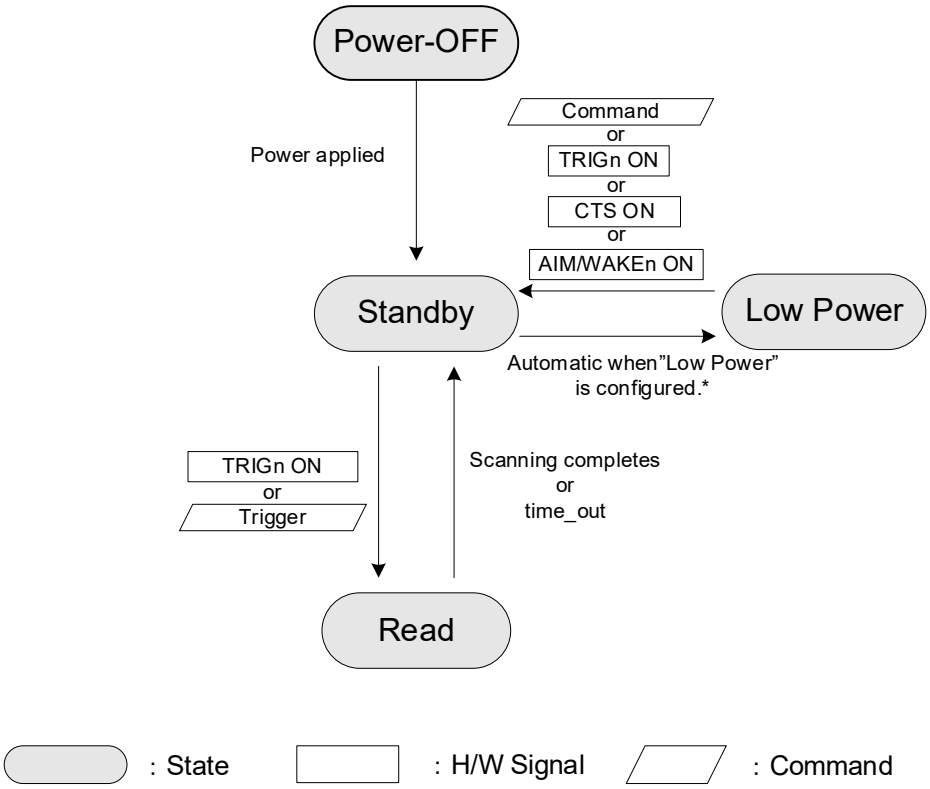
4.5. Current Waveform



* When Low Power Mode is enabled, the MDI-12 automatically enters Low Power state after Power On.

Figure 2: Current Waveform

5. Power Mode Transition



* When Low Power is enabled, the MDI-12 automatically enters Low Power mode after being in Standby for the specified time.

Figure 3: Power Mode Transition

Power Mode Status

Status	Description
Read	Imager engine is in the process of reading.
Standby	Ready to read. In this state, the MDI-12 can read immediately.
Low Power	Low current consumption state. The amount of time to shift from standby is configurable.

6. Interface Specifications

6.1. Interface Signals

The connector used is equivalent to the one produced by IRISO Electronics Co., Ltd.
Product No.: 9681S-12 (12pin, 0.5mm pitch bottom contact, 0.3mm thick FPC/FFC connector)

No.	Name	Function	I/O	Conditions	State	Notes
1	TRIGn	Trigger	In		L: Start operation H: No action	100kΩ pull up on imager engine
2	WAKEn	Recovery signal from Low Power state	In		L: Recover from low power state H: No action	100kΩ pull up on imager engine
3	GR_LEDn	Good read LED	Out		L: LED on H: LED off	4.7kΩ pull up on imager engine
	EX_ILLUM	Control of an external light source.	Out	Configured	L: External Illumination On H: External Illumination Off	
4	BUZZERn	Buzzer	Out		ACTIVE: PWM signal (frequency and duration configurable) IDLE: Steady high or low (configurable idle state)	A transistor or FET should be used to drive a buzzer. 100kΩ pull up on imager engine
5	POWERDWN	Indicates Low Power state	Out		L: Normal state H: Low Power state	4.7kΩ pull up on imager engine
6	RTS	Communication control signal to host system	Out			10kΩ pull up on imager engine
7	CTS	Communication control signal from host system	In	Interface configured as UART		100kΩ pull up on imager engine
	USB+	D+ signal for USB	In/ Out	Interface configured as USB		
8	TxD	Transmitted data signal	Out			10kΩ pull up on imager engine
9	RxD	Received data signal	In	Interface configured as UART		100kΩ pull up on imager engine
	USB-	D- signal for USB	In/ Out	Interface configured as USB		
10	GND	System ground				
11	V_{CC}	Power input	In		3.3V / 5.0V	
12	Reserve		In			N.C.

* Refer to the “Serial Interface Specifications” for details.

6.2. Interface Circuit

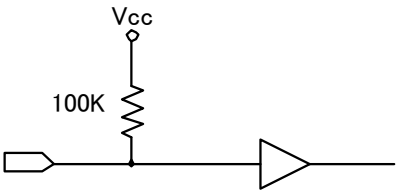
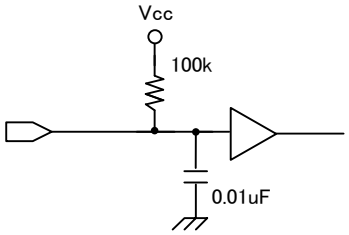
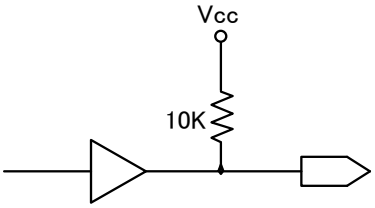
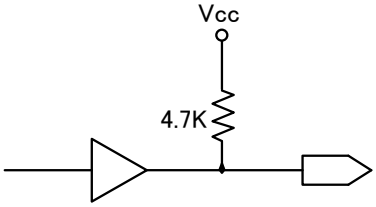
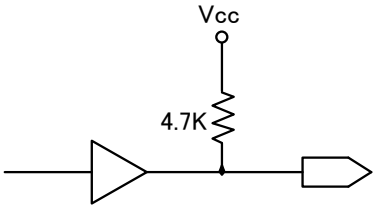
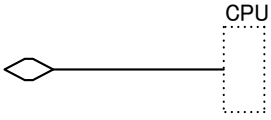
Signal Name	Circuit
WAKEn RxD CTS	
TRIGn	
RTS TxD	
GR_LEDn	
POWERDWN	
BUZZERn	
USB+ USB-	

Figure 4: Interface Circuit

7. Optical Specifications

Basic Optical Specifications

Specification		Characteristics
Scan method	CMOS area sensor (Monochrome)	-
Number of effective pixels	(H) × (V)	640 × 480 pixel
Image capture speed (*1)	Frame rate*1	120 fps
Image capture direction (*2)		Refer to Figure 5
Reading reference position	From the front edge of imager engine	Approx. 25 mm
View angle (*3)	Horizontal	about 120.0°
	Vertical	about 94.2°
	Diagonal	about 120.0°

*1 The fastest speed of image capture.
*2 The image direction during image capture can be changed by the setting.
*3 Imaging range. The readable area may vary depending on the code type and reading conditions.

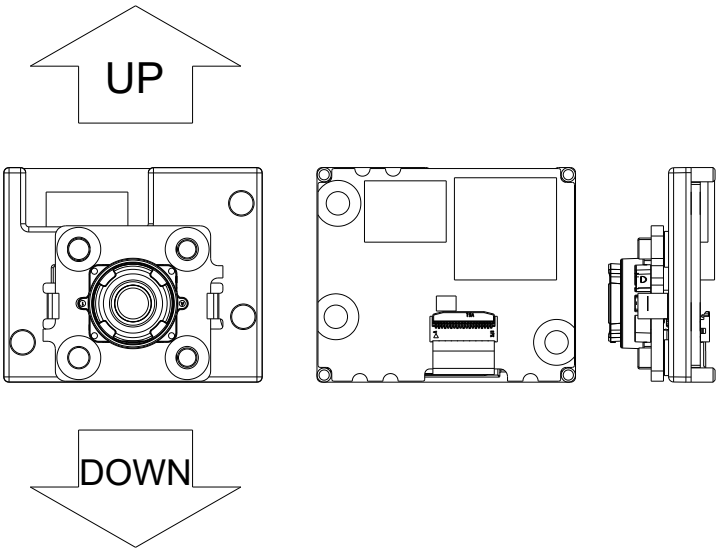


Figure 5: Image Capture Direction

8. Technical Specifications

The conditions for technical specifications are as follows, unless otherwise specified in each section.

Conditions

Ambient Temperature and Humidity	Room temperature and room humidity
Ambient Light	100 to 200 lux (on the surface of a barcode)
Tilt	α = 0°, β = 0°
Code Position	Center of the image
Curvature	R = ∞
Power Supply Voltage	3.3 and 5.0 V
Scanning Test	Accept the performance with 90% or more success rate for 10 scan attempts.
Barcode Test Sample (1D and 2D)	Specified below

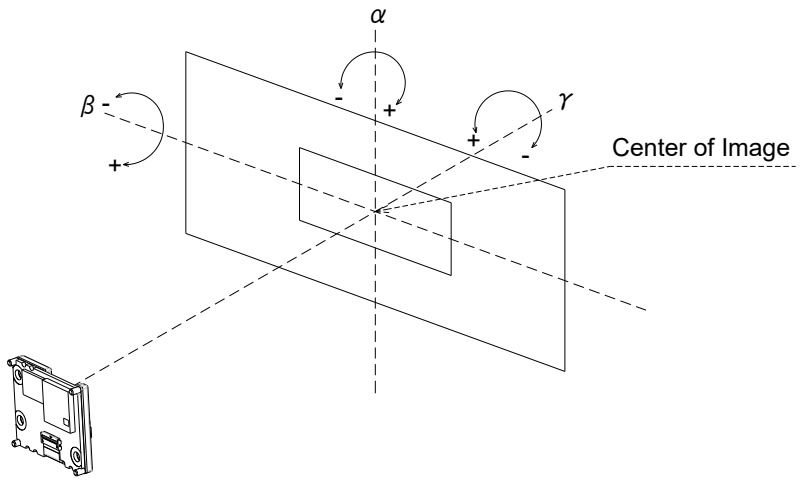


Figure 6: Test Condition of Depth of Field

8.1. Test Chart Labels

1D Barcode Test Labels

Code 39

Resolution	Symbology	PCS (MRD)	Size (mm)	No. of Digits
0.076 mm (3 mil)	Code 39	0.9 (80)	13 × 10	10
0.127 mm (5 mil)			11 × 10	4
0.20 mm (7.9 mil)			60 × 10	17
0.254 mm (10 mil)			32.5 × 10	7
0.508 mm (20 mil)			43 × 25	4

Code 128

Resolution	Symbology	PCS (MRD)	Size (mm)	No. of Digits
0.20 mm (7.9 mil)	Code 128	0.9 (80)	42 × 10	16

UPC/EAN

Resolution	Symbology	PCS (MRD)	Size (mm)	No. of Digits
0.330 mm (13 mil)	UPC/EAN	0.9/0.2 (80/13)	31.5 × 24.5	12/13

Codabar (NW-7)

Resolution	Symbology	PCS (MRD)	Size (mm)	No. of Digits
0.254 mm (10 mil)	Codabar	0.9 (80)	40 × 13	12

GS1 DataBar/Composite Test Labels

GS1-Limited

Resolution	Symbology	PCS (MRD)	Size (mm)	No. of Digits
0.127 mm (5.0 mil)	Limited	0.9 (80)	9 × 1.3	14
0.127 mm (5.0 mil)	Limited-Composite		9 × 2.5	26

2D Codes Test Labels

PDF417

Resolution	Error Correction	PCS(MRD)	Size (mm)	No. of Characters
0.127 mm (5.0 mil)	Level-3	0.9 (80)	17.3 × 7.5	58
0.254 mm (10 mil)			35 × 15	

QR Code: Model-2

Resolution	Error Correction	PCS(MRD)	Size (mm)	No. of Characters
0.127 mm (5.0 mil)	M	0.9 (80)	4 × 4	44
0.381 mm (15 mil)			11 × 11	
1.650 mm (65 mil)			48 × 48	

Data Matrix

Resolution	Model	PCS (MRD)	Size (mm)	No. of Characters
0.127 mm (5.0 mil)	ECC200	0.9 (80)	3 × 3	40
0.254 mm (10 mil)			6 × 6	

Note: Size is measured using the outline dimensions, excluding the quiet zone.

8.2. Scan Area and Depth of Field

The scan area is measured from the front edge of the engine. The depth of field depends on the view angle and symbol length. The depth of field values provided are the typical values measured at an ambient temperature of 25°C.

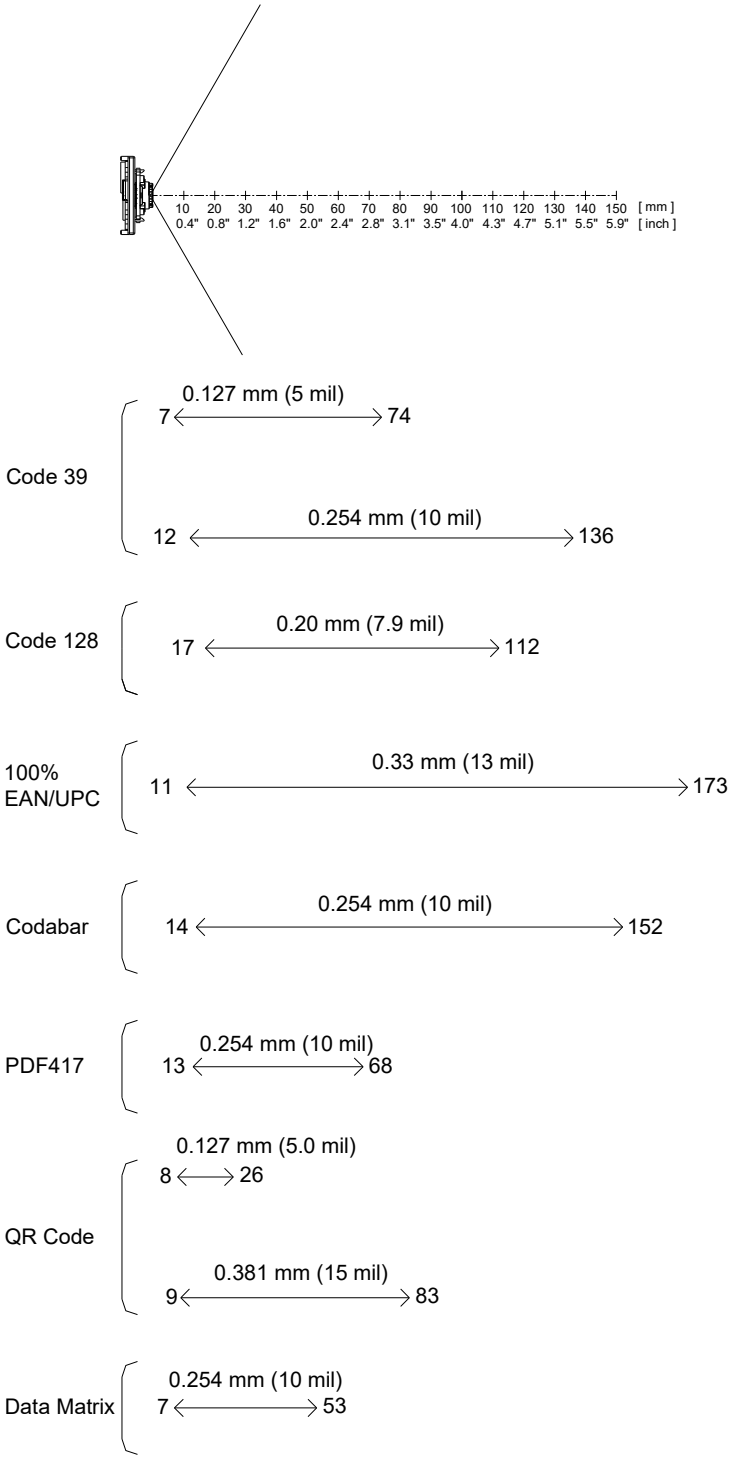


Figure 7: Scan Area and Depth of Field

8.3. Depth of Field

The scan area is measured from the front edge of the imager engine. The depth of field depends on the view angle and symbol length.

(T_A = 25C)

Resolution mm (mil)	Symbology Type	PCS (MRD)	Guaranteed Value		Typical Value	
			Near	Far	Near	Far
0.127 mm (5 mil)	Code 39	0.9 (0.8)	10 mm (0.39″)	63 mm (2.5″)	7 mm (0.28″)	74 mm (2.9″)
0.254 mm (10 mil)	Code 39	0.9 (0.8)	15 mm (0.59″)	109 mm (4.3″)	12 mm (0.47″)	136 mm (5.4″)
0.2 mm (7.9 mil)	Code 128	0.9 (0.8)	23 mm (0.91″)	95 mm (3.7″)	17 mm (0.67″)	112 mm (4.4″)
0.33 mm (13 mil)	UPC/EAN	0.9 (0.8)	15 mm (0.59″)	147 mm (5.8″)	11 mm (0.43″)	173 mm (6.8″)
0.254 mm (10 mil)	Codabar	0.9 (0.8)	18 mm (0.71″)	127 mm (5″)	14 mm (0.55″)	152 mm (6″)
0.254 mm (10 mil)	PDF417	0.9 (0.8)	16 mm (0.63″)	55 mm (2.2″)	12 mm (0.51″)	68 mm (2.7″)
0.127 mm (5.0 mil)	QR Code	0.9 (0.8)	11 mm (0.43″)	23 mm (0.9″)	8 mm (0.31″)	26 mm (1″)
0.381 mm (15 mil)	QR Code	0.9 (0.8)	13 mm (0.51″)	72 mm (2.8″)	9 mm (0.35″)	83 mm (3.3″)
0.254 mm (10 mil)	Data Matrix	0.9 (0.8)	10 mm (0.39″)	46 mm (1.8″)	7 mm (0.28″)	53 mm (2.1″)

8.4. Print Contrast Signal (PCS)

PCS: 0.2 or higher

Conditions

MRD	13 and higher (70% or higher reflectivity of space and quiet zone)
Barcode Sample	UPC specified in Chapter 8.1. (Resolution: 0.33 mm, PCS: 0.2)

MRD = Minimum reflectance of white space - Maximum reflectance of black bar

$$PCS = \frac{\text{Reflectance of white space} - \text{Reflectance of black bar}}{\text{Reflectance of white space}}$$

8.5. Minimum Resolution

1D Code:	0.076 mm (3.0 mil) Code 39 specified in Chapter 8.1
GS1-DataBar:	0.127 mm (5.0 mil) GS1 DataBar Limited specified in Chapter 8.1
Stacked Code:	0.127 mm (5.0 mil) PDF417, GS1 DataBar Limited Composite specified in Chapter 8.1
2D Code:	0.127 mm (5.0 mil) QR Code and Data Matrix specified in Chapter 8.1

Conditions

Angle	α = 0°, β =0°
Curvature	R = ∞

8.6. Code Width

1D Code:	60 mm Code39
2D Code:	Size 48 x 48 mm QR Code

Conditions

1D Code Sample	Resolution 0.20 mm Code 39 / PCS 0.9 specified in section 8.1
Distance	40 mm from the front edge of the imager engine
2D Code Sample	Resolution 1.65 mm QR Code / PCS 0.9 specified in section 8.1
Distance	45 mm from the front edge of the imager engine
Angle	α = 0°, β =0°
Curvature	R = ∞

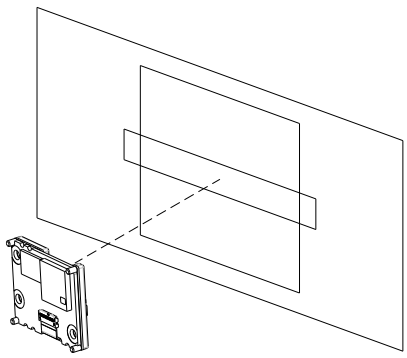


Figure 8: Code Width

8.7. Pitch, Skew, and Tilt

Pitch: α = ±55°
Skew: β = ±65°
Tilt: γ = 360°

Conditions

Barcode Sample	0.5 mm Code 39 specified in Chapter 8.1
Distance	50 mm from the front edge of the imager engine
Curvature	R = ∞

For pitch angle and tilt angle measurements, set the skew angle β to +0°.

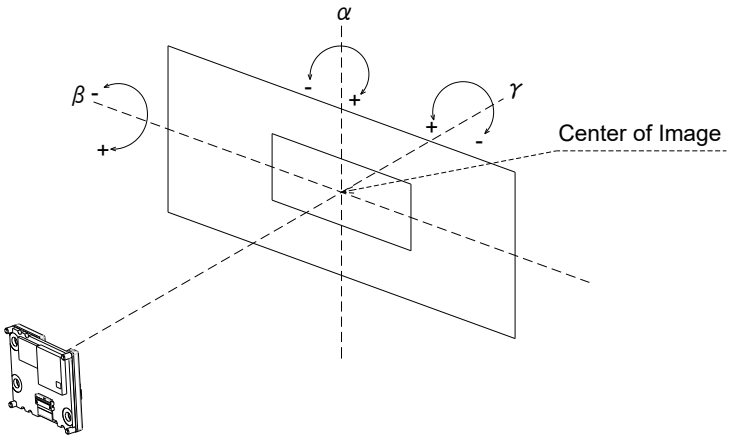


Figure 9: Pitch, Skew, and Tilt

8.8. Curvature

0.33 mm 12-digit UPC: R ≧ 20 mm

Conditions

Barcode Sample	0.33 mm UPC specified in Chapter 8.1
Distance	50 mm from the front edge of the imager engine
Angle	α = 0°, β =0°

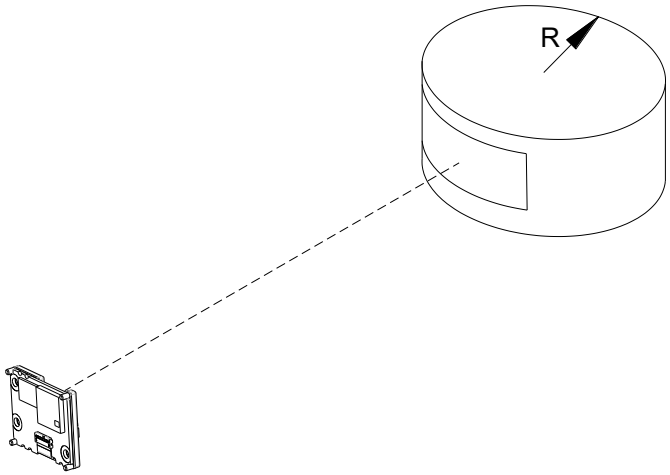


Figure 10: Curvature

8.9. Scan Speed

The number of scans per second
1D barcode: 30 Scans/Second
2D code: 25 Scans/Second

Conditions

Ambient Light	500 lux to 1000 lux (on the surface of a barcode)
Distance	35 mm from the front edge of the imager engine
Scan Mode	Continuous scan
Angle	α = 0°, β =0°
Code position	Center of the image
PCS (1D and 2D)	0.9 or higher
1D Code	UPC/EAN with 0.33 mm specified in Chapter 8.1
2D Code	Data Matrix with 0.254 mm specified in Chapter 8.1

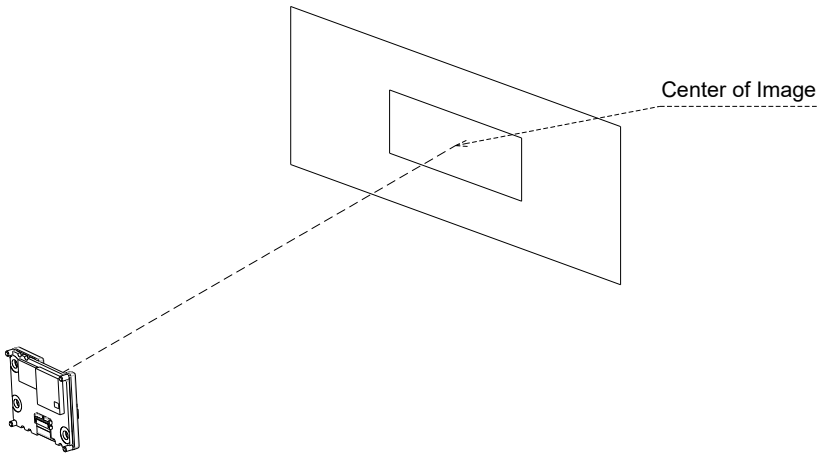


Figure 11: Scan Speed

Note: Reading performance may vary under other conditions.

9. Environmental Specifications

9.1. Temperature

Operating Temperature: -20 to 60 °C
Storage Temperature: -40 to 70 °C

Conditions

Barcode Sample	0.33 mm UPC specified in Chapter 8.1
Distance	35 mm from the front edge of the imager engine
Angle	α = 0°, β =0°
Curvature	R = ∞
Scanning Test	Read at intervals of 300 ms
Power Supply Voltage	3.3 and 5.0 V

9.2. Temperature

Operating Humidity: 5 to 90% RH (no condensation, no frost)
Storage Humidity: 5 to 90% RH (no condensation, no frost)

Conditions

Barcode Sample	0.33 mm UPC specified in Chapter 8.1
Distance	35 mm from the front edge of the imager engine
Angle	α = 0°, β =0°
Curvature	R = ∞
Power Supply Voltage	3.3 and 5.0 V

9.3. Ambient Light Immunity

Scanning performance is guaranteed when the illumination on the surface of a barcode is between zero and the following values:

Incandescent Light: 10,000 lux
Fluorescent Light: 10,000 lux
Sunlight: 120,000 lux

Conditions

Barcode Sample	0.33 mm UPC specified in Chapter 8.1
Distance	35 mm from the front edge of the imager engine
Angle	α = 0°, β =0°
Curvature	R = ∞
Power Supply Voltage	3.3 and 5.0 V

Note: To achieve the best scanning performance, make sure that direct ambient light does not enter the light receiving section of the MDI-12.

9.4. Electrical Noise

a) Scanning Symbologies
Scanning performance is not affected when the sinusoidal electrical noise (50 Hz to 100 kHz, smaller than 0.1 Vp-p) is added to the power supply line.

Conditions

Barcode Sample	0.33 mm UPC specified in Chapter 8.1
Distance	35 mm from the front edge of the imager engine
Angle	α = 0°, β =0°
Curvature	R = ∞
Scanning Test	Read at intervals of 300 ms
Power Supply Voltage	3.3 and 5.0V

b) Image Data Acquisition
Excessive noise or misalignments in acquired images will not occur when sinusoidal electrical noise (50 Hz to 100 kHz, smaller than 20 mVp-p) is added to the power supply line.

Note: Electrical noise may affect the quality of captured images. The signal processing system of the MDI-12 is specifically designed to scan symbologies not acquire image data. So, the quality of images captured by the MDI-12 may be lower than that of general-purpose digital cameras.

9.5. Vibration Tolerance

The MDI-12 is designed to withstand the conditions of the following vibration test.

Vibration Test: Increase the frequency of the vibration from 12Hz to 200Hz at a maximum acceleration of 32.3m/s^2(3.3G) for ten minutes. Continue the process for 2 hours in the X-direction, 2 hours in the Y-direction, and 4 hours in the Z-direction.

Conditions

Barcode Sample	0.33 mm UPC specified in Chapter 8.1
Distance	35 mm from the front edge of the imager engine
Angle	α = 0°, β =0°
Curvature	R = ∞
Power Supply Voltage	3.3 and 5.0 V

9.6. Drop Impact Tolerance

The MDI-12 is designed to withstand the conditions of the following drop test.

Drop Test: Fix the MDI-12 in a specific aluminum made dummy case. Drop the case a total of 10 times (from the top, bottom, front, back, left, right, top-left, top-right, bottom-left, and bottom-right faces) from a height of 1.8 meters onto a concrete floor.

Conditions

Barcode Sample	0.33 mm UPC specified in Chapter 8.1
Distance	35 mm from the front edge of the imager engine
Angle	α = 0°, β =0°
Curvature	R = ∞
Power Supply Voltage	3.3 V

10. Environmental Specifications

To connect the MDI-12 to a host system, use an FFC or FPC cable designed to meet the specifications provided by the connector manufacturer.

Recommended connector: Product No. 9681S-12 (12-pin, 0.5 mm pitch, 0.3 mm thick), produced by IRISO Electronics Co., Ltd.

Recommended cable length: Max. 50 mm. The resistance caused by the length of the cable must not drop the voltage to the imager engine below 3.0 V. For USB connections, design the differential impedance of the transmission line to be 90Ω±15%.

11. RoHS

The MDI-12 is compliant with RoHS.

RoHS: The restriction of the use of certain hazardous substances in electrical and electronic equipment.
Directive 2011/65/EU
Commission Delegated Directive (EU) 2015/863

12. Reliability

The imager engine will perform reliably if it is operated under normal operating conditions in the range of advised operating temperature and without excessive electrical or mechanical shock.

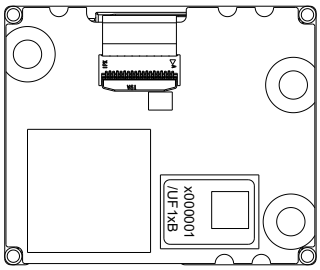
MTBF (mean time between failures) of this product is 518,417 hours.

13. Precautions

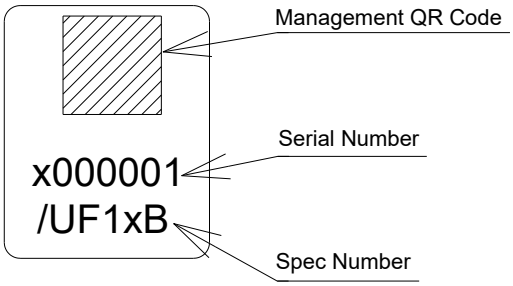
- All work-benches, tools, measuring instruments and any part of the human body which may come into contact with the MDI-12 must undergo antistatic precautions.
- Do not touch the optical and electrical components. When possible, hold the camera body when handling the MDI-12.
- Avoid handling the MDI-12 in a dusty area. If dust gets on the MDI-12, gently blow it off with dry air. Direct contact with the optical parts may reduce performance.
- Do not drop the MDI-12.

14. Product Label

The product labels are affixed to the MDI-12 as shown below.



The details of the label are as follows.



The serial number (seven-digits) starts from 1000001 or J000001 and is sequentially numbered.

Figure 12: Product Label

Note: B stands for UART interface in default.
DC stands for USB-COM interface in default.
D stands for USB-HID interface in default.

15. Packaging Specifications

Note: The “RO” mark labelled on the package tray or package box guarantees that the applicable product has passed our test of RoHS restrictions compliance (The restriction of the use of certain hazardous substances in electrical and electronic equipment, Directive 2011/65/EU, Commission Delegated Directive (EU) 2015/863.). However, this mark does not have any legal weight in the European Union.

15.1. Packaging

A carton box: 450 pieces MDI-12 (MAX)

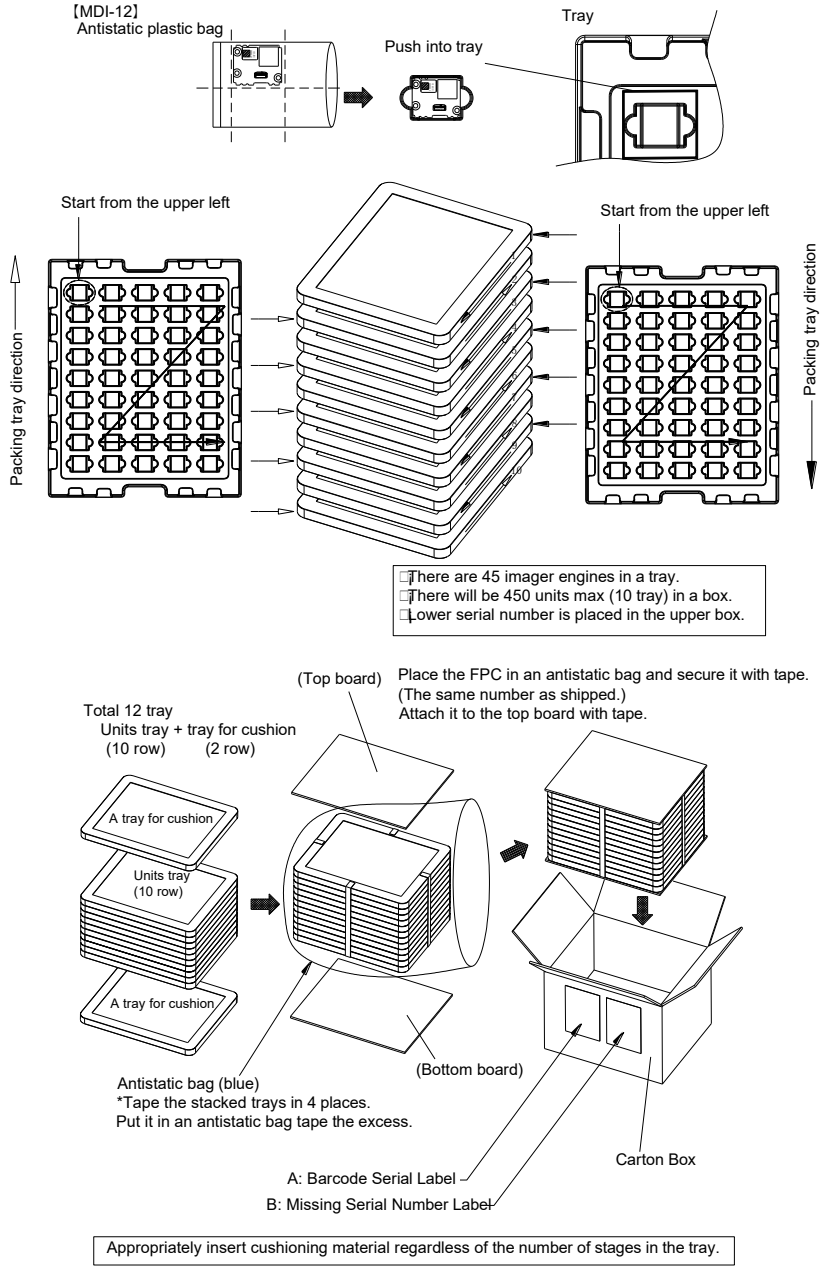
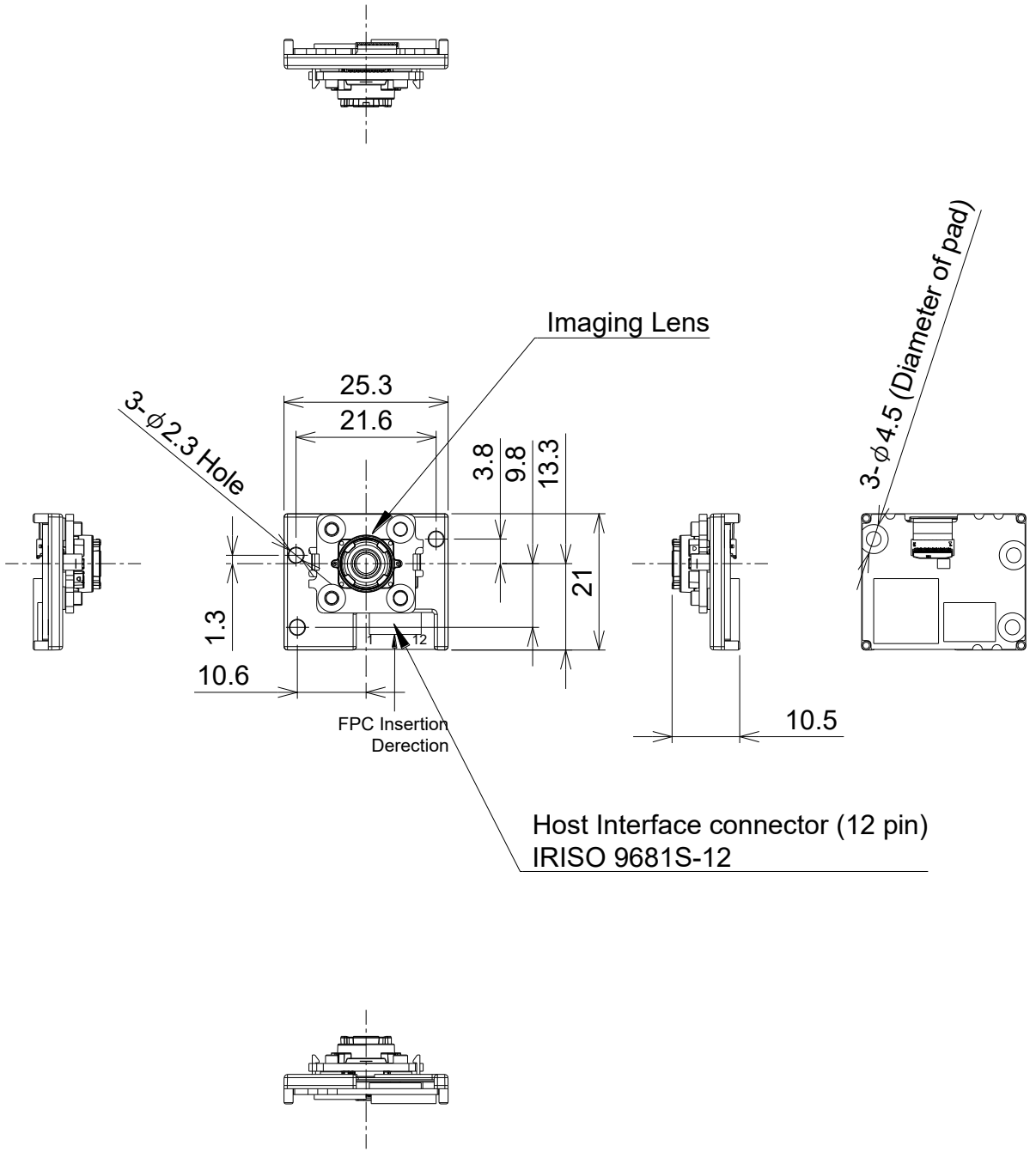


Figure 13: Packaging

15.2. Package Size

365 × 295 × 180 (WDH mm) (Outside dimensions)

16. Mechanical Drawing



[Unit: mm]

Figure 14: Drawing (MDI-12)